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Mode L Performance Improvements Surprise Even Optimists

The improvement in AO-10 Mode L performance over the last year has been astounding according to several veteran satellite users including Mode L expert Bill McCaa, KØRZ and AO-8 Mode J expert Frank Wiesenmeyer, K9CIS. Recent tests show surprisingly moderate power levels are adequate for enjoyable QSOs on the newest OSCAR mode.

When first launched in 1983, AO-10 Mode L showed disappointing performance. The required uplink power was about 10dB higher than anticipated according to Engineering Vice President Jan King, W3GEY. Failure analysis first focused on an antenna relay used to select either the 1269 helix or omni antenna for the Mode L receiver. Subsequent analysis, however, now makes this possibility seem less likely according to W3GEY. On the other hand, diagnosis by specialists in AMSAT DL as well as by AMSAT now points towards the HELAPS (High Efficiency Linear Amplification by Parametric Synthesis) amplifier as the culprit. According to W3GEY, DJ4ZC and his team at AMSAT DL strongly suspect a bias regulator in the HELAPS, a JANTXV 2N2222, as the failure locus. The HELAPS is consequently running as a Class C amplifier rather than its linear mode as designed. This reduces the output which in turn forces a stronger uplink for a given downlink signal. Some estimates a year ago suggested upwards of 30 kW EIRP were required for usable QSOs. That value compared with the pre-launch estimates of 2 to 3 kW EIRP.

Now, however, due to a number of favorable circumstances, performance appears to have improved to not only pre-launch expectation but beyond. A recent demonstration by K9CIS, for example, showed that a mere 1.4 kW EIRP was sufficient for a very satisfactory SSB QSO on Mode L. Moreover, Frank's straightforward approach to obtaining what at first blush seems prodigious amounts of power at 1269 MHz should encourage others to get started immediately on Mode L.

In a recent *ASR* telephone interview K9CIS described his Mode L transmitter. He uses a Microwave Modules transmit converter (2m to 24cm) which produces between 1 and 2 watts. This drives a single stage, one transistor amplifier which produces about 8 watts.

"I dump the 8 watts into a crummy piece of coax. About 3.5 watts comes out the other end to feed a 7-foot TV dish," K9CIS relates. "The feed is a simple 3½-turn helix wound for left-hand circular polarization. When reflected from the dish surface, that becomes right-hand circular, of course."

We inquired about the dish.

"A very old Channelmaster UHF TV dish; it's seven feet in diameter. At 50% feed efficiency I figure I get 26 dBi gain. With 3.5 watts, that gives me about 1400 watts EIRP and an 8 degree 3 dB beamwidth," Frank related.

Using that equipment K9CIS was 6 to 7dB above the noise in 2.4 kHz on SSB at WA2LQQ (2 X 18 elements; 0.5 dB NF GaAsFET on the mast).

According to KØRZ, the improvements in Mode L performance derive from several sources. "Since Mode L comes on well before apogee now, as compared to previously, the satellite is closer. The path loss improvements add up to about 5dB improvement," Bill told *ASR* recently. "The major improvement is *pointing angle," he added.* "The Mode L receive helix has a fairly narrow beam width and the choice of Mode L operating times is absolutely critical if reasonable performance is to be attained. The other major improvement comes from the re-biasing of the faulty output stage with heavy loading. For example, as an experiment, Cor, VE7BBG, would aim his big EME array at AO-10 and transmit. Instantly signals which were not heard before come up by many dB. The output stage is self-biasing to an extent with load so that it is running in a more linear regime. The same effect is noticed to a degree when the RTTY beacon comes on to replace the PSK beacon."

K9CIS says the improvement in downlink when the RTTY telemetry is on can amount to as much as 6 dB. AMSAT is looking into ways to keep the RTTY beacon on more of the time according to W3GEY.

Meanwhile, satellite controller VE1SAT says that we can look forward to continued favorable pointing angles for Mode L for the foreseeable future. K9CIS adds that he is aware of Japanese Mode L operators having successful CW QSOs with only 10 watts to a single loop Yagi! In other words, if you do it right, you can get along with 1 kW EIRP or less. But (and this is a big "But"), you have to get all the parts "right". The point is that it would appear that at present Mode L performance can be not only as good as but superior to pre-launch estimates. The news of improved

Mode L performance is expected to strongly encourage further inroads on that mode by those now experienced on Mode B. Many Mode L newcomers are reportedly amazed by the absence of spin modulation and QRM. The lure of more than 800 kHz of spectrum is bound to be an attraction. Meanwhile, K8OCL has begun to identify those elements to be considered for a Mode L bandplan. With the advent of Mode L voice bulletins later this spring and the improved performance more than evident, John points out that it may be time to begin thinking about how this vast territory (Mode L spectrum) might be organized. With the Mode L performance improvements now manifest and becoming known to an increasing number of users, the stage may be set for Phase IIIC now less than 18 months from launch. This bird may include a Super L mode with up to several hundred watts of downlink power available from its HELAPS amplifier. In an upcoming *ASR* we will highlight currently available Mode L equipment. According to K9CIS, he is on Mode L having made a nominal $200 improvement over his Mode B station.

Short Bursts

• February 17th has been declared "W6CG" day on AO-10 to honor the veteran spacecraft commander and operator. The announcement of this honor, virtually unique to date, was made at an AFCEA Ham Radio Luncheon 31 January in Anaheim, CA. An AMSAT Special Achievement Award plaque was presented to Bud along with a special citation from AMSAT President WA2LQQ. The presentation was made by AMSAT Chairman W6SP and arranged by N6DD. Congratulations on this truly distinguished award!

• Some rare satellite DX has shown up recently. XE1TU led a satellite DXpedition to Revilla Gigedo operating as XF4MDX 8-10 Feb. Unfortunately, the announcement was received too late for prior issue. But here's one that you can catch if all comes together as planned. WD4FAB is helping to arrange for an AO-10 station to be operated from the very rare YI1BGD in Bagdad, Iraq! Watch for this one coming through your radio soon.

• Congratulations to two new Area Coordinators. They are Lyle Mabbott, W7KMF, for Wyoming and Robert Barbee, W4AMI, for Tennessee. Welcome aboard to these newest "A-Team" members! Additional team members still required in ID, ND, AR, MS, VT, NE, SC and ME. Any takers? These billets are going fast thanks to WA6VGS (Chief Area Coordinator).

• The first printing of the popular Satellite Experimenter's Handbook has sold out. The 13,000 copies of the first printing lasted about a year. ARRL advises a second printing will be off the presses on or about 1 Mar. 85. Orders for this excellent book by former AMSAT Director Dr. Marty Davidoff, K2UBC, will be filled as soon as copies are available according to AMSAT Office Manager Martha Saragovitz. AMSAT realizes a small commission on books sold through it so it naturally encourages your patronage to the AMSAT bookstore.

• The Project OSCAR orbital prediction calendars have been mailed according to Project OSCAR officials.

• Project OSCAR held its annual meeting at the Foothill College, Los Altos, CA, on Saturday, February 2. Several excellent presentations were given including a status report on Project Companion by Jim Eagleson, WB6JNN. Jim explained how ACSSB techniques are being introduced to amateur SSB equipment and what it can mean in terms of improvements in voice communications. (See related story elsewhere in this issue.) The major organizational business was the election of officers. At press time we were aware that W6SP was re-elected Chairman and W6XN was re-elected President. Congratulations!

• The launch of the next ham-in-space is holding at 9 July 85 according to AMSAT's VP-Manned Space, Bill Tynan, W3XO. WØORE will carry a sophisticated equipment suite if the approval cycle goes as expected.

Space Symposium and Annual Meeting organizer W6SP.

Chauncey Uphoff, World Space Foundation, speaks on Solar Sail.

• AMSAT's Software Exchange desperately needs a consultant who can help newcomers get started with the various programs the exchange has in stock. In particular, AMSAT needs someone who can answer telephone question on using the IBM-PC version of the W3IWI orbital prediction program. Interested? Call Martha at 301-589-6062. Thanks!

• The Institute is a monthly news supplement to the IEEE (Institute of Electrical and Electronic Engineers) journal, Spectrum. The February issue of The Institute has a fine article on PACSAT based on interviews with W3GEY and W4RI. Good reading in the professional media. Copies? SASE to WA2LQQ at P.O. Box 177, Warwick, N.Y. 10990-0177 will get you a copy.

• Additional prize selections in the member recruitment drive (See also *ASR* 94/95) were: K8OCL selected the KLM 2m-22C antenna donated by KLM. John chipped in a few dollars of his own and upgraded the donated antenna to the new, super long KLM 435-40CX. Ramon Traver, WA2LJM, selected the Tokyo High Power HRA-2 mast mounted GaAsFET preamp donated by EnComm. Dick Ruhr, WD5GLD, selected the new rotor control computer interface by Spectrum West. Dick selected the unit which works with the Vic 20 computer. Paul Beeman, KA2MUM, selected the Tokyo High Power 70 cm power amplifier model HL-45U donated by EnComm. Al Brinckerhoff WB5PMR, selected the KLM 435-18C antenna donated by KLM. Our sincere thanks to these diligent recruiters. A special note of thanks to the fine sponsors who donated these great prizes. Over the next few weeks we'll be featuring some of these products here to introduce AMSAT members to the distributors who have supported this important member recruitment drive. We say thanks and pledge our support to you in return. Thanks!

• A German DXpedition to Antarctica features DPØGVN operating SSB on 145.920 MHz through March 1. His QTH is 71° south, 8° west. QSL to DJ4ZO. *Thanks WA2RDE.*

Mark Bergam, Solar Sail Project Manager.

• A 4S7 station using equipment loaned by ON7HP is expected on OSCAR-10 throughout March.

Compandor Kits Coming Soon

Project OSCAR's Jim Eagleson, WB6JNN, tells *ASR* that while the ACSSB kits offered by ARRL in the Project Companion effort provide state-of-the-art analog voice processing, a meaningful improvement can be obtained with very simple compressor/expander chips readily available. Jim says he and several others are putting together a simple bolt-on accessory kit which will be available soon. The unit will offer about 2-to-1 compression and expansion. This will provide some improvement in signals but less than the 4-to-1 compression/expansion on the STI ACSSB design. If you'd like information on these kits send a SASE to WB6JNN, 15 Valdez Lane, Watsonville, CA 95076. These processors have the advantage of working in the AF circuits rather than in the i-f. That qualifies them as "bolt-ons" rather than "surgical implants" as is most often the case with i-f processors.

AMSAT Officials to Brief Nebraska Confab

AMSAT will be well represented at the upcoming Nebraska ARRL Spring Convention the last weekend in March. Symposium speakers will be John Champa, K8OCL, executive vice president and acting vice president of operations, as well as Ralph Wallio, WØRPK, assistant vice president for operations.

At a Saturday symposium, Champa will describe AMSAT, its current activities, and its plans for the future. Wallio will explain what packet radio is and how radio amateurs can participate in that new and exciting form of digital communications.

The convention will be hosted by the Midway Amateur Radio Club of Kearney, Nebraska, best known in the U.S. for its sponsorship of the popular North American Teleconference Radio Network. In fact, convention attendees will be treated to a first-hand look at how teleconferencing works when the club stages a live network on Friday night from the Holidome. The guest will be Jim Larsen, K7GE, of Larsen Antennas. The net will begin at 8 PM CST.

Other speakers planned for the convention are ARRL headquarters staffer Steve Place, WB1EYI, ARRL Midwest director Paul Grauer, WØFIR, and his vice director, Dick Dyas, WØJCP. Joe Eisenberg, WAØWRI, will brief the convention on the difficult problems of frequency coordination and radio-frequency interference.

The convention will be held at the Holiday Inn in Kearney on March 30-31. For more information, contact the Midway Amateur Radio Club at P.O. Box 1231, Kearney, NE 68847.

Dayton Conference Caters to VHF/UHF afficianados

Satellite operators and terrestrial communicators will both find this year's International VHF/UHF Conference of in-

terest. The event will be held from April 26, 27, and 28 in conjunction with the Dayton Hamvention and will feature a noise-figure contest, antenna gain measurements, and technical forums.

There are no forums scheduled for Friday this year so that attendees can explore the famous flea market and commercial exhibits. But at 1800, after the Hara Arena closes and the RF interference drops, the noise-figure contest will begin. Prizes will be awarded to winners in the homebrew category for preamplifiers operative on amateur bands from 144 to 2304 MHz.

The technical forums begin at 0900 on Saturday and will cover such topics as antennas, propagation, dynamic-range measurements, and contesting. The antenna-gain measurements start at 0900 on Sunday behind the Hara Arena. A new and improved range is being prepared. Certificates will be awarded for the highest gain and the best figure of merit. Again, prizes will be garnered by winners in the homebrew category for antennas on 144, 220, 432, and 1296 MHz.

For more information, contact the conference moderator, Jim Stitt, WA8ONQ, at 311 N. Marshall Road, Middletown, OH 45042.

ORBIT PREDICTIONS BY KA9Q

Satellite:	***OSCAR-9***
Catalog number:	12888
Epoch time:	85020.10896642
Sun Jan 20 02:36:54.698 1985 UTC	
Element set:	724
Inclination:	97.6169 deg
RA of node:	4.5514 deg
Eccentricity:	0.0004402
Arg of perigee:	76.3809 deg
Mean anomaly:	283.7869 deg
Mean motion:	15.26884341 rev/day
Decay rate:	1.395e-05 rev/day²
Epoch rev:	18263
Semi major axis:	6860.235 km
Anom period:	94.309697 min
Apogee:	504.955 km
Perigee:	498.915 km
Ref perigee:	2576.12283146
Sun Jan 20 02:56:52.637 1985 UTC	
Beacon:	145.8250 MHz

Satellite:	***OSCAR-10***
Catalog number:	14129
Epoch time:	85021.81116101
Mon Jan 21 19:28:04.311 1985 UTC	
Element set:	157
Inclination:	26.0373 deg
RA of node:	156.9529 deg
Eccentricity:	0.6005771
Arg of perigee:	341.6988 deg
Mean anomaly:	3.5310 deg
Mean motion:	2.05854222 rev/day
Decay rate:	4.7e-07 rev/day²
Epoch rev:	1211
Semi major axis:	26105.658 km
Anom period:	699.524152 min
Apogee:	35406.380 km
Perigee:	4049.459 km
Ref perigee:	2577.80639631
Mon Jan 21 19:21:12.641 1985 UTC	
Beacon:	145.8100 MHz

OSCAR-9
Mon Feb 11 01:30:13.582 1985 UTC:
Ascending node at 136.6
Nodal period: 94.36618 min
Longitude increment:
23.589203 deg w/orbit
Element set 724, epoch:
Sun Jan 20 02:36:54.698 1985 UTC

OSCAR-11
Mon Feb 11 01:19:39.371 1985 UTC:
Ascending node at 51.8
Nodal period: 98.55760 min
Longitude increment:
24.638786 deg w/orbit
Element set 54, epoch:
Wed Jan 23 03:57:45.186 1985 UTC

RS-5
Mon Feb 11 01:32:00.836 1985 UTC:
Ascending node at 150.6
Nodal period: 119.55279 min
Longitude increment:
30.015164 deg w/orbit
Element set 216, epoch:
Mon Jan 21 11:22:55.271 1985 UTC

RS-7
Mon Feb 11 01:58:58.968 1985 UTC:
Ascending node at 161.8
Nodal period: 119.19368 min
Longitude increment:
29.925311 deg w/orbit
Element set 187, epoch:
Fri Jan 11 01:01:23.796 1985 UTC

RS-8
Mon Feb 11 00:02:07.846 1985 UTC:
Ascending node at 125.6
Nodal period: 119.76177 min
Longitude increment:
30.067462 deg w/orbit
Element set 308, epoch:
Sat Jan 19 11:06:40.423 1985 UTC

Final PACSAT Technical And Management Review Meeting 9-11 March 1985

The following important announcement from VITA was received by *ASR*:

This meeting, funded by the Hoover Foundation, will be held in Washington, D.C. March 9-11. It is being co-sponsored by VITA and AMSAT. One, and possibly two days, will be held at Goddard Space Flight Center so that NASA GAS-can people and PACSAT volunteers can begin to interact. The remaining day(s) will be held at VITA in Roslyn (across the river from Georgetown, DC).

A detailed agenda is in the works. While there will be technical working sessions, the prime purpose of the meeting is to explore the options available to complete the project in time for a possible January 1987 launch within the context of likely limited availability of funding (although we are pressing for commitments from those foundations still "sitting on the fence" prior to the meeting).

We must decide on the course of action to take, with all its technical and management implications, at this meeting. Parts of the Launch Service Agreement must be completed by 17 July 1985 or the project loses its place in line. Sometime shortly after this document is submitted, the Payload Accommodations Requirements document must be completed and submitted.

VITA special projects coordinator Sheila Ferguson will be coordinating details of the meeting. Both EIES and TELEMAIL will be read regularly. Sheila can be reached by telephone at (703) 276-1800.

The "Bob and Wray" team of Ohio comprises (left) Bob Roger, W8JLE and Wray Dudley, W8GQW.

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